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ART UNIT	PAPER NUMBER
2623	

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Please find below and/or attached an Office communication concerning this application or proceeding.

	Application No.	Applicant(s)
Office Action Summary	09/750,188	BRADY, THOMAS S.
	Examiner	Art Unit	
	Kevin Siangchin	2623	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on <u>25 June 2004</u>.

2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) <u>1,3-5,7,9-12,14,17,18 and 21-25</u> is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) <u>1,3-5,7,9-12,14,17,18 and 21-25</u> is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☒ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on <u>05 May 2004</u> is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a) ☐ All b) ☐ Some * c) ☐ None of:

      1. ☐ Certified copies of the priority documents have been received.

      2. ☐ Certified copies of the priority documents have been received in Application No. _____.

      3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☒ Interview Summary (PTO-413) Paper No(s)/Mail Date. <u>4·26·04</u>

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

Detailed Action

Drawings

Response to Drawing Corrections

1.   New and corrected drawings were received on May 5, 2004. These drawings are not acceptable. Figure 6

illustrates, quite generally, the Applicant's claimed compression methodology – the so-called *AGFA technique*

(henceforth, referred to interchangeably as *AT*). The Applicant has chosen to omit several fundamental steps of the

AFGA technique. An exhaustive listing of these missing steps will not be provided. For example, Figure 6 does not

illustrate the step of adding unidentified strings of symbols to the code dictionary. Since the AFGA technique is

disclosed only by example, the drawings aid in concretely defining the algorithmic steps involved. Essential steps

should, therefore, not be omitted. Again, with regard to Figure 6, it is not clear why the Applicant uses dashed lines

between steps 6060 and 6080, and between steps 6080 and 6040, etc. According to the AFGA technique, the flow of

execution does not occur between these step in the alternative or optionally. For example, should step 6060 yield a

negative result, the number of characters is evaluated against a threshold (i.e. step 6080). According to AT, step

6080 will always (not optionally) follow a negative result in step 6060. The dashed lines are, therefore, unnecessary

and should be removed. In doing so, the multiple "NO" branches (i.e. to steps 6070 and step 6080) emanating from

step 6060 should be replaced with a single branch to step 6080. Finally, step 6080 should indicate somehow that the

run-length is compared against a threshold. The current caption, "THRESHOLD?" is insufficient.

2.   Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application.

Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version

of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should

not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the

replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made

to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be

necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled

"Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

Response to Amendments to the Specification

3.   The amendments to the Specification, filed May 5, 2004, have been acknowledged. These amendments resolve all issues raised in the previous Office Action, and do not introduce any new matter.

Objections

4.   The disclosure is objected to because of the following informalities:

      a.   On page 9, line 2, the word "value" is misspelled as "valve".

      b.   On page 10, paragraph [0028], line 2, the word "converts" is misspelled as "coverts".

      c.   On page 16, paragraph [0046], last sentence, the phrase ""the invention determines if" should be removed.

      d.   On page 18, line 3, the phrase "if the sub-string ..." should be replace with the text "if so, the sub-string ...".

Appropriate correction is required.

Claims

Response to Amendments to the Claims

5.   The amendments to the Claims, filed June 25, 2004, have been entered and made of record. Claims 5, 7, 9, 11, 12, 14, and 17 have been amended, accordingly. Claims 2, 6, 8, 13, 15, 16, 19, and 20 have been canceled, and claims 21-25 have been added.

Response to Arguments and Remarks

6.   The Applicant's arguments, filed May 5, 2004, (referred to, henceforth, as *Applicant's Remarks*) have been fully considered. They are addressed below.

7.   First, the Applicant's remarks regarding the applicability of Notenboom's   (U.S. Patent 4,955,066) method to image data (Applicant's Remarks, page 14, paragraph[1] 1) will be treated. The discussion presented in response to these remarks applies generally to compression algorithms where the application to image data may not be immediately apparent. This discussion may prove to be pertinent to the Rejections below. The other comments set forth in the Applicant's Remarks are rendered moot, in light of the new grounds for rejection and the newly cited Prior Art.

8.   It was well known, at the time of the Applicant's claimed invention, to apply the various component compression techniques of Notenboom's method – e.g. run-length encoding (RLE) and Huffman encoding – individually to the compression of image data. Although Notenboom's disclosure is clearly directed to textual data, it does not preclude the applicability of the disclosed method to other forms of data – in particular, image data. It would be understood by one of ordinary skill in the art that data – be it textual or image data – must expressed in terms of some discrete and fundamental unit of data. Typically, this fundamental unit is a *byte* or *bit*. In and of itself, a byte of image data having a given value is indistinguishable from a byte of textual data having the same value. The distinguishability of these data is derived from their respective contexts. This may be defined with respect to some "semantic" context, wherein the disparate data have some physical or conceptual meaning. More often, however, compression algorithms, such as that of Notenboom, are concerned with the mathematical or statistical context in which the data appears. Such algorithms attempt to exploit the statistical properties of the data, such as redundancy or entropy. These properties characterize all data, and the degree to which they manifest themselves within the data is similar across various types of data. As a result, algorithms, such as that of Notenboom, that are prescribed for a particular type of data may have broader applicability to other types of data. That is, although data types may differ

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[1]   When referring to paragraphs in the cited references, the convention followed here is that the paragraph number is assigned to paragraphs of a given column (if applicable) or section, sequentially, beginning with the first full paragraph. Paragraphs that carry over to other columns will be referred to as the last paragraph of the column in which they began.

semantically (e.g. text and image), their statistical similarities allow an algorithm prescribed for one type to be

applied to the other, without a deviation from the essence of the algorithm.

Objections

9.   Claim 21 is objected to because of the following informality. On line 3 of Claim 21 a space should separate

the words "character" and "of". Appropriate correction is required.

Rejections Under 35 U.S.C. § 112(2)

10.   The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject
> matter which the applicant regards as his invention.

11.   Claims 1, 4, 5, 7, 14, 17, 18, and 21 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite

for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

12.   *The following is in regard to Claims 4, 5, 12, 14, 17, 18, and 21.* Claims 4, 5, 12, 14, 17, 18, and 21 recite

the limitation "the second sequence of characters". There is insufficient antecedent basis for this limitation in the

claims. The "second sequence of characters" will be treated as the "output sequence of characters" in accordance

with independent Claims 1, etc.

13.   *The following is in regard to Claim 10.* Claim 10 recites the limitation "the first sequence of characters".

There is insufficient antecedent basis for this limitation in the claims.

14.   *The following is in regard to Claims 1, 7, and 14.* The current language of these claims seems to indicate

that *only* "a first character in an input sequence", and possibly a set of repeating characters immediately subsequent

to the first character, are subject to the claimed compression. This is contrary to the Applicant's disclosure, wherein

other characters are evaluated and encoded that may or may not be repeating characters matching the first character.

The language of the Claims should be rephrased to somehow reflect this.

15.   Any character in the input sequence (perhaps with the exception of the last) can be considered a first

character, in the sense that any given character in the sequence is the first character of the sub-sequence of

characters that immediately follow it. This is the manner in which "a first character" will be treated throughout this document.

16.   Claims 1, 7, and 14 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP § 2172.01. The omitted steps are:

    a.   The determination of whether sub-sequences of characters or strings of characters, in the input sequence, match entries of the code dictionary; in terms of the current claim language: the determination of whether these sub-sequences match any of the sub-sequences that have previously been assigned a "compression code defined during processing". Refer, for example, to paragraphs [0053] on page 18 of the Specification and [0061]-[0062] on page 22 of the Specification. According to the current claim language only "a first character in an input sequence" is examined.

One cannot properly conceive of the Applicant's claimed invention without the inclusion of this step. Other essential steps not addressed here may also be missing from the Claims. The Applicant is advised to carefully review the Specification and include, in the claim language, all steps necessary to satisfactorily define his/her/their invention.

Rejections Under 35 U.S.C. § 112(1)

17.   The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

18.   Claim 5 and 12 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

19.   In these claims, the Applicant claims that the output (see the U.S.C. § 112(2) rejections above) "sequence of characters has a predefined bit-length". The discussion in paragraph [0026] of the Specification (page 9)

notwithstanding, the specification lends no support to such claims. In general, one cannot determine *a priori* the length of the output sequence encoded according to the Applicant's disclosed compression methodology. This would require complete, *a priori* knowledge of the input data (e.g. the number of *runs* present in the input data, the frequency with which strings of symbols repeat in the input data, etc.). Though such knowledge can be determined by pre-processing the input data prior to compression, no such pre-processing is disclosed. Furthermore, the output sequence generated according to Applicant's proposed compression method will not, in general, have a fixed size. The code-length (or, more specifically, the bit-length) of codes, obtained according to dictionary compression schemes, is influenced by several factors, including the size of the dictionary, the size of the initial *vocabulary*, and the frequency with which strings of symbols repeat. Even RLE -encoded codes, which may consist of a fixed number of symbols (e.g. run-symbol and run-count), may have varying bit-lengths. This arises because of the variability of the run-count or, more particularly, the variability in number of bits required to express the run-count, as suggested in paragraph [0026] of the Specification. That said, two elements of the output sequence could be viewed as fixed in terms of their bit-lengths: the predefined compression codes (PCC) and the individual symbols constituting the output code (this includes the PCC).

20.   In paragraph [0026] of the Specification, the Applicant states that the "[output] sequence of characters may be limited to a predefined bit-length". However, the Applicant continues on lines 3-4 of paragraph [0026]: " if the number of repeating characters is very large and therefore cannot be entirely represented in a single code within the predefined limit, a second code will be required to complete the encoding". It can be inferred from paragraph [0026] (and paragraph [0056]) that the predefined bit-length applies primarily to RLE-encoded codes, generated according to the Applicant's method (though, as stated above, each of the code symbols in the output sequence could be fixed in length). It is clear, though, that the output code sequence is not fixed in length, regardless of whether it is RLE-encoded or encoded using "compression codes defined during processing" (i.e. dictionary-encoded). Rather, the RLE codes consist *initially* of a predetermined number of bits (e.g. 9, 10, 11, or 12 bits) and can extend beyond that predetermined number if necessitated by a large run-count. Essentially, it is the run-count of the RLE code whose length varies. Clearly then, a fixed-length output sequence, as proposed in Claims 5 and 12, is not supported by the Applicant's Specification.

Preface

21.   The following is a brief discussion relating to how the Examiner views the Applicant's disclosed invention, vis-à-vis the so-called AGFA technique (AT). This is presented primarily to motivate the Prior Art rejections below.

22.   Essentially, the AGFA technique is a straightforward combination of the well-known run-length encoding (RLE) and Lempel-Ziv (LZ) compression techniques. The details of the former were presented in the previous Office Action and the latter is discussed in the Applicant's *Background of the Invention*. LZ algorithms, and their variants, belong to a class of compression algorithms called dictionary compression algorithms[2]. The effectiveness of LZ algorithms is known to degrade when confronted with long strings of redundant symbols. RLE, on the other hand, optimally compresses such strings, though it has little utility in the compression of highly variable strings. Clearly, in this manner, RLE and LZ are complementary and, as such, seem well suited for combining. Indeed, combining the two compression methodologies is well known, as shown in Prior Art cited below.

23.   The Applicant has chosen to extend this combined methodology (or limit its functionality, depending on one's point of view) by initializing the code dictionary to contain a set of predefined codes that are representative of white image data and black image data (and other "control" codes). Furthermore, the Applicant restricts the application of RLE to only white or black image data. These proposed modifications are straightforward and would have been obvious to one of ordinary skill in the art, particularly if one assumes some prior knowledge of the input image data. This is discussed more fully below.

Rejections Under 35 U.S.C. § 103(a)

24.   Before proceeding, please note the following. As no clean version of the Amended Claims was provided, reference will be made to the marked-up "Listing of Claims" provided in the Applicant's *Supplemental Response to Notice of Non-Compliant Amendment*, filed June 25, 2004.

25.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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2   In fact, LZ and dictionary compression are often referred to synonymously.

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

26.   Claims 1, 3-4, 7, 9-11, 14, 17-18, and 23-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over [Fallon03] (U.S. Patent 6,597,812).

27.   *The following is in regard to Claim 7.* [Fallon03] disclose a method of lossless data compression which exploits various characteristics of run-length encoding (RLE), parametric dictionary encoding, and bit packing ([Fallon03] Abstract). The method uses both predefined compression codes (e.g. the 259 entries of the initialized code dictionary $(D)^3$ – [Fallon03] column 8, lines 5-10 and column 6, lines 35-38) and compression codes defined during processing (e.g. "dynamically added" codes – [Fallon03] column 6, lines 40-43). The method comprises (refer, generally, to the example given in [Fallon03] column 10, lines 4-67 to column 11, lines 1-44):

(7.a$_f$.)   Reading a first character[4] in an input sequence of characters (e.g. [Fallon03] Fig. 2A, step 203[5]).

(7.b$_f$.)   Since all possible byte values are contained in the dictionary, the first character of the

input sequence is assumed to correspond to one of the initial entries. Subsequent first

characters[4] are examined ([Fallon03] column 10, lines 18-20). If a character does not

match any of the entries in the code dictionary D, then that character is added to D and

assigned a "compression code defined during processing" (e.g. a dictionary index D[i]).

Refer to [Fallon03] column 8, lines 50-55 and column 9, lines 1-10, 17-20, and 25-27.

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3   These will be referred to as *initial entries*. According to [Fallon03] ([Fallon03] column 6, lines 35-38), 256 of the 259 initial entries (i.e. entries D[3]-D[258]) contain a character or byte corresponding to one of the possible values a single byte can represent. These are analogous to the predefined compression codes (PCC) of the Applicant's disclosure, in the sense that they are predefined and representative of common symbols or symbols expected to be present in the input data. Further notice that the dictionary of [Fallon03] contains reserved *control* codes ([Fallon03], column 6, lines 14-33) – e.g. a reset code (D[0]), a "run-length" code (D[1]), and an end code (D[3]). The similarity of these codes to those depicted in Figure 3 of the Applicant should be apparent.

4   Any character in the input sequence (perhaps with the exception of the last) can be considered a first character, in the sense that any given character in the sequence is the first character of the sub-sequence of characters that immediately follow it. This is the manner in which "a first character" will be treated in this document.

5   Notice that the caption in [Fallon03] Fig. 2A, step 203 reads "Read Next Input Byte". After initialization this "next" byte is actually the first byte of the string. See [Fallon03] column 8, lines 19-21. See also [4].

(7.c$_f$.)   Reading characters occurring immediately subsequent to the first character (e.g. the *next consecutive input bytes* – [Fallon03] Fig. 2A, step 204). Refer to [Fallon03] column 8, lines 23-35.

(7.d$_f$.)   Determining that the next consecutive input bytes match the first character[4] in the input sequence of characters. Refer to [Fallon03] column 8, lines 23-35. See also [Fallon03] column 10, lines 15-29.

Note that (7.c$_f$.) and (7.d$_f$.) occur upon a determination that the first[4] character corresponds to an entry in the code dictionary. See [Fallon03] column 10, lines 9-29. Notice there that, after the first character, "a", has been read and determined to be a member of the code dictionary, the next consecutive input bytes (e.g. "b") are analyzed (7.c$_f$.) and, depending on the result, RLE (7.d$_f$.) is commenced. This is also apparent from [Fallon03] Figs. 2A-2B. Observe the flow of execution from step 211 to step 214 to step 202 and, finally, to step 205. Steps 211-212 encompass the "determination that the first[4] character corresponds to an entry in the code dictionary", while steps 204-205 encompass (7.c$_f$.)-(7.d$_f$.) above. From this perspective, steps 211-212 clearly precede steps 204-205 (notice the position of Ⓑ in [Fallon03] Fig. 2A). In [Fallon03], RLE proceeds typically:

(7.e$_f$.)   The first[4] character and the set of matching next consecutive input bytes are represented by an "output" code comprising ([Fallon03] column 8, lines 33-39):

    1.   An RLE control code (i.e. D[1]).

    2.   A predefined compression code corresponding to the first character (e.g. the code word stored in the dictionary corresponding to the first[4] character, C).

    3.   The number of next consecutive input bytes matching the first[4] character (hereinafter, the *run-count*).

28.   The compression methodology of [Fallon03] is not shown to have specific applicability to image data. More particularly, [Fallon03] does not explicitly disclose supplying predefined compression codes representative of black image data and white image data. Furthermore, [Fallon03] does not disclose the application of RLE specifically to strings of repeating black image data or white image data, as indicated in Claim 7.

29.   Please refer to the discussion in preceding section of this document entitled, "Response to Arguments and Remarks". In view of that discussion, it should be clear that, although not disclosed, the compression method of

[Fallon03] is applicable to image data. This is particularly true when one takes into account the prior applications of the method's component compression techniques – i.e. dictionary (LZ) compression and RLE – to images and image data. Indeed, one would expect the method of [Fallon03] to be effective in the compression of image data because, as demonstrated in [Fallon03] and pointed out above, the incorporation of RLE into LZ overcomes the shortcomings of LZ. Image data is known to consist of regions of uniform color and, therefore, contains strings of redundant bytes. As shown above, the method of [Fallon03] accommodates redundancy well. Given this, it would have been obvious to one of ordinary skill in the art, at the time of the Applicant's claimed invention, to apply the method of [Fallon03] to image data.

30.   As stated above, the code dictionary of [Fallon03] is initialized so as to contain symbols which are expected to be encountered in the input data stream. Areas of uniform black and uniform white may abound an image, depending on the type of image (e.g. text or grayscale images). Furthermore, being the extremes of the color spectrum, these colors are common to nearly all images. Official Notice is taken. Therefore, in an application of [Fallon03] to image data, it would have been obvious to one of ordinary skill in the art, at the time of the Applicant's claimed invention, to provide entries in the code dictionary (predefined compression codes) corresponding to white image data symbols and black image data symbols, as such symbols are likely to be encountered in typical images. Because [Fallon03] performs RLE to sets of repeating symbols in the input data stream, areas of uniform black and uniform white would, in turn, be run-length encoded, where again the code consists of an RLE control code, a PCC (i.e. the dictionary index $D[i]$ corresponding to either a white image data symbol or black image data symbol), and a run-count. Inherent to such an image-based application of [Fallon03] is the determination of whether a first[4] character represents either one of a white image data symbol or black image data symbol. This follows directly from step (7.b$_f$.) above.

31.   Certain types of images are predominantly black and white (e.g. grayscale image, binary images, text, etc.). Clearly, the image data associated with such images consists primarily of black image data symbols and white image data symbols. In keeping with teachings of [Fallon03], one would naturally provide entries in the code dictionary that are representative of black image data symbols and white image data symbols, since these symbols are expected in the input image data. This was discussed previously. Moreover, to limit the size of the code dictionary one could advantageously restrict the code dictionary (aside from the aforementioned control codes) to include only entries

corresponding to a black image data symbol and a white image data symbol. Clearly, for predominantly black and white images, such a restriction has a negligible effect on the performance of the compressor. Therefore, in order to accommodate these types of images while providing a minimally sized code dictionary, it would have been obvious to one of ordinary skill in the art, at the time of the Applicant's claimed invention, to restrict the code dictionary of an image-based implementation of [Fallon03] (aside from the aforementioned control codes) to initially include only entries corresponding to a black image data symbol and a white image data symbol.

32.   In summary, it would have been obvious to one of ordinary skill in the art, at the time of the Applicant's claimed invention, to apply [Fallon03] to image data – or more specifically, image data that is predominantly black and white – and, in order to accommodate such images efficiently, to restrict the code dictionary (aside from the aforementioned control codes) to entries corresponding to a black image data symbol and a white image data symbol. The resultant method would include:

(7.a.)   Reading a first[4] character in an input sequence of characters representing an image. See
          step (7.a$_f$.) above.

(7.b.)   1.   Determining whether the read first[4] character represents either one of a white image
               portion or a black image portion (i.e. determining whether the first character has a
               corresponding entry in the code dictionary – cf. [Fallon03] column 8, lines 53-55 and
               column 10, lines 15-22).

          2.   Upon the determination that the first[4] character does not represent either of a white or
               black portion of the image (i.e. the first character has no corresponding entry in the
               code dictionary), representing the first character with an output sequence comprising
               a compression code defined during processing (cf. [Fallon03] column 9, lines 1-10,
               17-20, and 25-27).

Upon determination that the first character does represent one of a white portion and a black portion of the image (i.e. the first character has a corresponding entry in the code dictionary – see steps (7.c$_f$.)- (7.e$_f$.)):

(7.c.)   Reading characters occurring immediately subsequent to the first character in the

sequence of characters.

(7.d.)   Determining the number of repeated subsequent characters that match the read first

character in the input sequence of characters.

(7.e.)   Representing the first character and the determined number of repeated subsequent

characters with an output sequence of characters comprising a PCC corresponding to the

one of the white and the black portion of the image (i.e. the dictionary index D[i]

corresponding to either a white image data symbol or black image data symbol – see

above).

33.   *The following is in regard to Claims 1.* A hardware implementation of the compression method discussed

above would represent an encoder and would inherently comprise a memory for storing the code dictionary (and,

hence, the PCCs) and a processor configured so as to execute the aforementioned methodology. The substantive

limitations of such an implementation have been addressed above with respect to Claim 7. For the sake of brevity,

that discussion will not be repeated.

34.   *The following is in regard to Claim 14.* A hardware implementation of the compression method discussed

above would represent an imaging system, as such an implementation would entail the processing of image data.

Such a system would inherently comprise a processor configured so as to execute the aforementioned methodology.

Because that processor would process image data (digital images are rasters), it can be considered a raster image

processor. The substantive limitations of such an implementation have been addressed above with respect to Claim

7. For the sake of brevity, that discussion will not be repeated.

35.   The compressed output sequence generated by such a processor serves little purpose in its compressed

form. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the Applicant's claimed

invention, to provide the imaging system with a means to decode the compressed image data into its original form.

Such a means can be reasonably viewed as an image controller, in the sense that, with the "raw", decompressed

image data, it can be used to control various external raster devices (e.g. monitors, printers, etc.).

36.   *The following is in regard to Claims 3, 9, and 17.* As shown above, the result of RLE in [Fallon03] is a

code consisting of an RLE control code, a PCC (i.e. code corresponding to an initial entry representative of the first[4]

character), and the run-count. Furthermore, it was shown that, with the straightforward modifications described

above, the PCC resulting from RLE process is representative of either a black image data symbol or a white image

data symbol.

37.   In the compression method of [Fallon03], RLE commences only when it has been determined that the

number of consecutive matching immediately following the first[4] character (i.e. the run-length) is greater than a

threshold s. See [Fallon03] column 8, lines 23-39. This effectively addresses the subject matter set forth in Claim 9.

Analogous arguments can be made for Claims 3 and 17.

38.   *The following is in regard to Claim 10.* The value s in [Fallon03] is presumably predefined and, therefore,

defined prior to the reading of the first[4] character in the input sequence.

39.   *The following is in regard to Claims 4, 11, and 18.* As mentioned above, RLE according to [Fallon03]

produces a code consisting of a run-count. Again, this value is indicative of the "number of characters in the

matching one or more characters". Similar arguments apply to Claims 4 and 18.

40.   *The following is in regard to Claims 23-25.* In [Fallon03], each byte of the input data is sequentially read

(i.e. "substituting the next subsequent character in the input sequence [of bytes] for the first[4] character") and

processed, until there are no more input bytes to process (i.e. the condition in [Fallon03] Fig. 2A, step 202 is not

satisfied). This is apparent from the process loop depicted in [Fallon03] Figs. 2A and 2B. This effectively addresses

the subject matter set forth in Claims 23-25.

41.   Claims 5, 12, 21, and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over [Fallon03], in view

of [Yellin98] (U.S. Patent 5,727,090).

42.   *The following is in regard to Claims 5 and 12.* As shown above, it would have been obvious to one of

ordinary skill in the art, at the time of the Applicant's claimed invention, to modify [Fallon03] so as to efficiently

compress predominantly black and white image data. The result, as shown above, would have been a method

satisfying the limitations of Claim 7. As stated above, the compressed output code, generated according to

[Fallon03], consists of dictionary indices, $D[i]$. These serve as the code symbols composing the output code. Since

dictionary D is limited to a fixed maximum size, indices $D[i]$ are of a fixed bit-length (i.e. the constituent code

symbols are of fixed bit-length). See [Fallon03] column 6, lines 48-51 and column 7, lines 29-40. Note that, in

[Fallon03], the run-count also has a fixed bit-length, as implied in [Fallon03] column 13, lines 7-19 and 38-43[6].

[Fallon03], however, does not disclose the inclusion of a *continuation code* within the code symbols, or within the

compressed output code.

43.   [Yellin98] disclose a method for storing run-length encoded raster image data, wherein each run is

indicated by a variable-length sequence of bytes with the repeated symbol expressed in a fixed-length field and the

run-count in a variable-length field ([Yellin98] Abstract). With the exception of the last byte, each byte of the RLE-

encoded code consists of a continuation code (or, *concatenation flag*, using the nomenclature of [Yellin98] –

[Yellin98] column 2, lines 11-18; see also Fig. 1). Each run is represented by a sequence of bytes; the first byte

includes the color from the color pattern (i.e. the repeating input symbol) and, in the remaining space, the most

significant bits of the run-count; the lower bits of the run-count trail into additional bytes whose continuation codes

have been asserted. Refer to [Yellin98] column 2, lines 11-23; column 4, lines 44-55; column 5, lines 16-35; and

Fig. 1.

44.   Clearly, the usage of concatenation flags by [Yellin98] allows the run-count to occupy any number of

bytes. As a result, very long runs of input symbols can be properly encoded. The concatenation flags further the

provide RLE codes with readily distinguishable boundaries[7]. See [Yellin98] column 4, lines 51-55. Therefore, in

order to support the compression of long runs of input symbols, it would have been obvious to one of ordinary skill

in the art, at the time of the Applicant's claimed invention, to further modify the method of [Fallon03] so as to

generate variable-length RLE codes, such as those of [Yellin98], which include a continuation code in each of the

constituent bytes. The result is a method of compression that conforms to that of Claim 12. The rejection of Claim 5

follows similarly.

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6   Note that [Fallon03] treats both ("X" and "N") as words, each word presumably having the same length.

7   The boundaries are demarcated by an "OFF" concatenation flag.

45.   *The following is in regard to Claims 21-22.* As just discussed, the RLE codes, constructed according to

[Yellin98], include a run-count that may occupy a variable number of bytes (i.e. a "multi-character value

corresponding to the number of characters in the matching one or more characters"), wherein each of the constituent

bytes includes a concatenation flag (i.e. a "continuation bit"). The RLE codes of [Yellin98] also consist of a PCC

representative of the repeating color (i.e. the *color number* from the color palette – [Yellin98] column 2, lines 19-

20), though it would be understood that, in combination with [Fallon03], that PCC would be an initial entry[3] of the

code dictionary representative of either a white image data symbol or a black image data symbol. This sufficiently

addresses the subject matter set forth in Claims 21-22.

Citation of Relevant Prior Art

46.   The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

47.   [ZivLempel77] and [Welch84] introduce the LZ and LZW compression methods, respectively. As stated

above, the Applicant's disclosed method shares several key algorithmic features with LZ compression techniques.

The theoretical background of these techniques is, therefore, considered to be pertinent to any discussion related to

the Applicant's compression methodology.

[ZivLempel77]   J. Ziv and A. Lempel, *A Universal Algorithm for Sequential Data Compression.*
                 IEEE Transactions on Information Theory, 1977.

[Welch84]   T. Welch, *A Technique for High-Performance Data Compression.* IEEE, 1984

48.   The following disclose methods of compression that combine LZ or dictionary-based compression with

run-length encoding.

[Kosaraju98]   S.R. Kosaraju and G. Manzini, *Compression of Low Entropy Strings with Lempel-*

Ziv Algorithms. IEEE, 1998.

[Ouaissa95] K. Ouaissa, M. Abdat, and P. Plume, *Adaptive Limitation of the Dictionary Size in LZW Data Compression*. Proceedings of the International Symposium on Information Theory, 1995.

[Obrien91] J. O'Brien, *U.S. Patent 4,988,998*, Filing Date: September 1989.

[Berlin97] G. Berlin, *U.S. Patent 5,701,125*. Filing Date: June 1994.

[Seroussi95] G. Seroussi and A. Lempel, *U.S. Patent 5,389,922*. Filing Date: April 1993.

[Cooper01] A.B. Cooper, *U.S. Patent 6,268,811*. Filing Date: September 2000.

49. [Reynar99] discloses an LZ compression technique that utilizes predefined compression codes to represent symbols "frequent in the domain from which the data being compressed is drawn". Similar to [Fallon03], [Reynar99] stores these symbols in a "pre-filled" code dictionary.

[Reynar99] J.C. Reynar et al., *U.S. Patent 5,951,623*. Filing Date: August 1996.

50. The following disclose the usage of *continuation codes* in various compression methodologies.

[Igata00] N. Igata et al., *U.S. Patent 6,057,790*. Filing Date: September 1997.

[Burrows99] M. Burrows, *U.S. Patent 6,005,503*. Filing Date: February 1998.

[LeeLee96] D. Lee and R. Lee, *U.S. Patent 5,570,340*. Filing Date: May 1995.

Conclusion

51. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

52. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period,
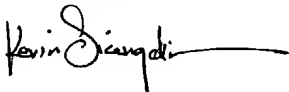
then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee

pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however,

will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be

directed to Kevin Siangchin whose telephone number is (703)305-7569. The examiner can normally be reached on

9:00am - 5:30pm, Monday - Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can

be reached on (703)308-6604. The fax phone number for the organization where this application or proceeding is

assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information

Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR

or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more

information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the

Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Kevin Siangchin

Examiner
Art Unit 2623

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